Summary of meteorological observations at Michilimackinac (Mackinac), Mich., from August, 1802, to April, 1803, both inclusive

	Temperature									Days with precipitation	Days with snow	Days with thunderstorms	Days with fog	Clear	Partly cloudy	Cloudy	Wind—prevailing direction
	Mean [1]	Maximum	Minimum	Mean Maximum	Mean Minimum	Range											
						Mean daily	Greatest	Least	Absolute								
1803																	
January	13.3	36	−14	16.5	9.2	7.2	20	0	50	8	8	0	0	17	3	11	W.
February [2]	17.7	50	−24	24.4	9.8	14.8	34	2	74	1	1	0	0	24	0	3	S.
March	25.2	49	−10	30.3	19.4	10.9	24	0	59	8	3	0	4	17	2	12	W.
April	39.4	59	20	45.4	33.2	12.2	30	1	39	12	3	1	0	14	5	11	E.
1802																	
August	67.4	83	36	71.9	62.1	9.7	32	2	47	7	0	3	4	23	1	7	SW.
September [3]	61.8	73	40	65.9	57.5	8.9	26	2	33	6	0	1	1	19	4	6	N.
October	51.0	72	30	55.4	46.5	8.6	18	2	42	9	2	0	2	11	2	18	N.
November	41.9	60	29	44.2	39.4	4.9	15	1	31	7	3	0	4	10	1	19	S.
December [4]	21.0	49	−11	24.0	17.5	6.6	15	0	60	7	7	0	1	16	2	12	N.

[1] Mean of 3 observations, sunrise, noon, and sunset. [2] Record for 27 days. [3] Record for 29 days. [4] Record for 30 days.

Measurement and determination of magnitude of cooling. (By Dr. V. Conrad, Vienna, reprinted from Gerlands Beiträge zur Geophysik Vol. XXI, Part 2/3, 1929.)—Summary: From January to April, 1928, observations with L. Hill's katathermometer were being made at the sanatorium Grafenhof (Salzburg). Synchronous measures of air temperature and wind velocity (with the anemometer) allowed a comparison between the cooling power observed with the Kata (H) and calculated out of the wind velocity and air temperature with Doctor Hill's formula (h). The investigation shows: (1°) That the quotient H/h is very little influenced by the air temperature; (2°) that there is a functional connection between the value of H/h and the wind velocity. Within certain bounds, given by the present observations it is possible to express the mentioned connection analytically. The size of H/h reaches values >2 at very little velocities and becomes nearly constant (0.9) at velocities >1 m/s. If the conclusions drawn from the present material hold, it will be possible to calculate the cooling power in mgcal/cm², sec. out of wind velocity and air temperature (for velocities >1 m/s) with Hill's formula slightly corrected.

Tornado, May 1, 1929, at Fort Smith, Ark. (By Truman G. Shipman).—The morning weather map of May 1, 1929, showed a troughlike barometric depression extending from the Rio Grande Valley northeast across the middle Lakes region. A pressure reading of 29.48 inches was reported at Abilene, Tex. An extensive HIGH covered the western portions of the United States with a pressure reading of 30.36 inches at Boise, Idaho. Sharp drops in temperature and steep temperature gradients were noted over western Texas and the southern Rockies. A rather well defined line of opposing winds appeared near the center of the trough. The P. M. map showed much the same conditions moved eastward with a low pressure reading of 29.38 inches over Little Rock, Ark. The morning map of May 2, 1929, published at Washington, D. C., showed that the southern center of the depression moved about 1,250 miles in 24 hours or about 52 miles an hour.[1] This is considerably less than the velocity of the tornado as it passed over Fort Smith.

Telephone calls and weather conditions indicated the presence of a tornado at 2:30 p. m. The beginning of the tornado could not be seen from the office as it approached from the opposite side of the building. An attempt was made, but given up to reach the roof at this time. After the storm had passed northeast of the building, two office employees ascended to the roof and saw the tornado cloud over Sand Prairie, Crawford County.

The tornado formed in Oklahoma and was observed by a bus driver along the Fort Smith-Gore Highway. It was also observed at Peno, Okla., about 4 miles west of Fort Smith. It almost followed the path of the tornado that struck Fort Smith, May 28, 1924, and seemed to be high in the air as that storm was. The first funnel cloud observed in Fort Smith appeared where Wheeler Avenue crosses the Missouri Pacific tracks where it hit the Fort Smith Handle Co.'s plant. This cloud was described as a ropelike or serpentlike formation swaying in the air, but rather clear and distinct. The heaviest damage was inflicted here and along a path about one-fourth to one-half mile to the east. The second tornado cloud was shaped like a sheaf and was wide and less distinct. The third cloud was an inverted cone which did not reach the ground but formed immediately after the second. The storm then seemed to pass almost entirely over the city doing only light, scattered damage until its reached Sand Prairie, Crawford County, about 8 miles distant. This tornado cloud was observed by the employees of the office from the roof of the Federal Building in Fort Smith at 2:37 p. m. The cloud was shaped like an inverted truncated cone, rather wide and poorly defined and its outlines somewhat dimmed by light rains. The tornado had traveled 8 miles in 7 minutes at about 69 miles an hour which is close to the extreme wind velocity as recorded at the Weather Bureau office. In general the path was slightly north of east and very narrow. The nearest part of the path lay about 1¼ miles southeast of the office building.

Before the arrival of the first funnel-shaped cloud in Fort Smith at Wheeler Avenue and to the right and in the rear of where the cloud formed, an educated and reliable observer reported rain descending in sheets, clouds seemed to be boiling over and between the sheets of descending rain, an open space. He interpreted this as a wide, sheaf-shaped vortex without the cloud sheet leaving it transparent.

At a few times in the path of this tornado, what appeared to be explosive effects accompanied by vapor were seen and reported by observers, including Mr. Baughman of the Weather Bureau office. These observations are quite interesting and would indicate that the temperature in the tornado funnel varied during its progress, ranging from slightly below to slightly above the dew point. The thermograph at the Weather Bureau office, 1¼ miles distant, showed a temperature of 66° (fig. 1) at the time of the tornado and a dew point of 63° was observed at a special observation at 2:50 p. m.

[1] It is preferred to believe that there was a rise in pressure in the southern end of the trough which would automatically transfer the center to the north, rather than that there was an actual progression of the southern center.—ED.

Portions of transparent tornado funnels have been reported frequently and have been observed by the writer in another storm. Storms are frequently observed in Fort Smith that approach tornadoes and may have invisible vortices. Clouds show boiling effects, parallel opposing cur-

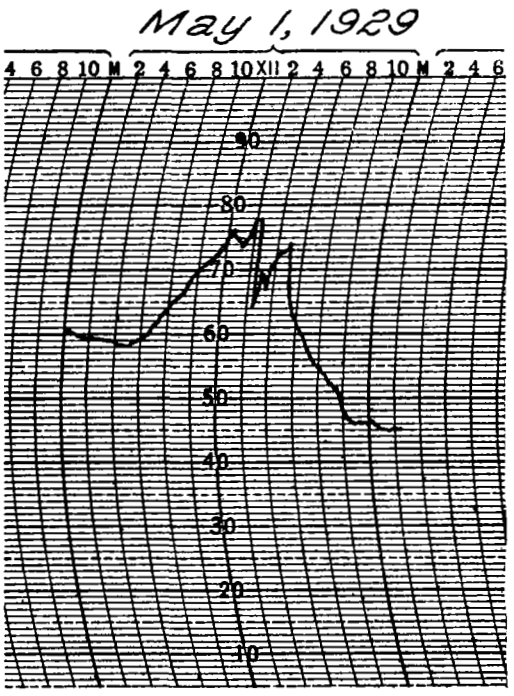

FIGURE 1.—Thermograph trace, Fort Smith, Ark., May 1, 1929

rents and vortices. The details of clouds in these storms are quite distinct showing striated effects, clouds moving in echelon, and mammato-cumulus forms are seen.

Tornado clouds are formed by the cooling of the air below the dew point by expansion incident to the decrease of pressure caused by rapid whirling.

It is interesting to note the chronological order of appearance of tornado cloud forms. The ascending currents without the outside cloud sheet, producing boiling effects and scud are the first to appear. The earlier funnels are usually thin, ropelike, and rather sharply defined like moisture condensing on the outside of a cold vessel. This condition lasts only a very short time as the cloud sheet rapidly thickens to a cone-shaped funnel. If this goes on further, rain falls and the funnel cloud is obscured or may disappear on account of diminishing intensity of the whirl.

The barograph during the storm of May 1 showed a pressure of 0.14 inch (fig. 2) during the two hours preceding, a fall of 0.09 inch during the storm, and a rise of 0.11 immediately after it. The lowest reading was 29.23 inches. Temperature showed a drop of 13° during the storm's passage. Unfortunately the wind partially failed to record and only a partial record was obtained. The maximum velocity as near as could be computed was 62 miles an hour and the extreme 74 miles. The velocity of the tornado was near the extreme velocity. The wind shifted 180° in one minute during the passage of the tornado. Practically all directions were represented by cloud and surface wind movements during the day. Opposing currents were observed in clouds during storm and an imposing display of cumulo-nimbus was observed immediately afterwards.

An interesting feature occurred in connection with the Fort Smith Handle Factory damage. The side walls of this building were blown outward as the funnel cloud passed, but the roof was not blown upward. The roof had a ventilating stack extending upward that relieved the upward pressure. Houses damaged in other parts showed roofs blown upward.

The damage in Fort Smith was light. Fortunately the storm was high in the air and it struck only one edge of the city with any degree of force. The damage in Fort Smith was estimated at $25,000. Five persons were hurt at Fort Smith and seven at Sand Prairie, Crawford County.

At 3:30 p. m. of the same day, Rex, a village 98 miles slightly north of east of Fort Smith was wiped out by a tornado. Two persons were seriously hurt and four received lighter injuries. The damage to this village was estimated at $40,000. Typical tornado clouds and conditions were reported. It was first thought this was the tornado that struck Fort Smith as it lies in the same direction of progress, but 98 miles an hour seems a rather high velocity for a tornado.

Severe hailstorm at Springfield, Ill., May 1, 1929. By C. J. Root).—A severe hail storm occurred in southern Illinois on the afternoon of May 1. It covered a strip varying from 2 to 6 miles in width and extended across Williamson and parts of Jackson and Saline Counties.

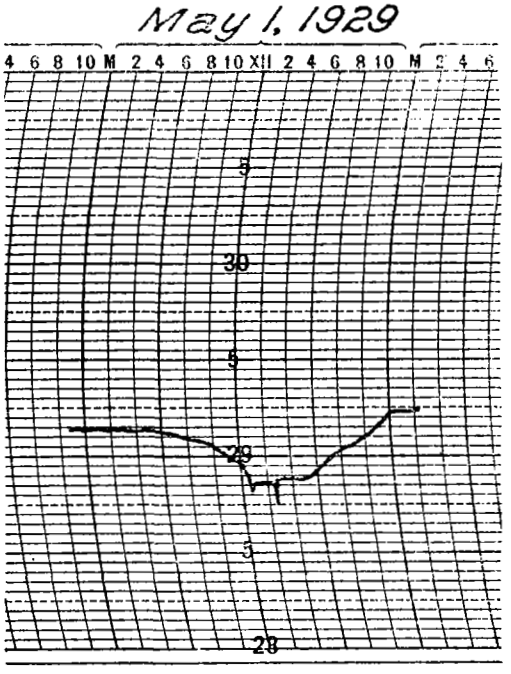

FIGURE 2.—Barograph trace, Fort Smith, Ark., May 1, 1929

Near the south edge of the path hail fell to a depth of several inches, the stones being about the size of marbles. At the Marion cemetery, at the north edge of Marion the writer saw the entire cemetery group of trees entirely denuded of foliage and having the appearance of midwinter. Shrubbery and small limbs were badly barked. Farther north the stones were larger but more scattered, causing less damage to vegetation but more to property. Stones were reported up to the size of hen eggs, and there were numerous instances of roofs and automobile tops being punctured. The losses will total several hundred thousand dollars.

Progressive desiccation in southwest Africa.—The late Prof. E. H. L. Schwarz, during his 10 year's work on the Geological Survey of Cape Colony, realized the extent to which some parts of the country had been impoverished